Michigan Educational Assessment Program

Science Grade 8
Scoring Guide for
Released Item #14
Effects of Light Color
Fall 2006

MICHIGAN Department of Education

ANSWER THE FOLLOWING CONSTRUCTED-RESPONSE ITEM IN YOUR ANSWER DOCUMENT.

14 Constructed Response (3 points)

A student records these findings of an experiment in which the same type of bean plant was grown under different colors of light.

Effects of Light Color on Bean Plants

Bean Plant	Light Color	Starch Present in Leaf
1	White	91 mg
2	Yellow	10 mg
3	Green	13 mg
4	Blue	68 mg
5	Red	72 mg
6	No Light	4 mg

- Draw a scientific conclusion based on the data above.
- Explain how the data from the experiment supports your conclusion.
- Describe a way to gather more evidence to support your conclusion.

NOTHING WRITTEN IN THIS TEST BOOKLET WILL BE SCORED.

Science Rubric for Effects of Light Color

Sample Response:

Conclusions and Explanations:

- Light contains many colors and many of these colors contribute to photosynthesis. This is supported by the varying amounts of starch produced for each different color.
- Green and/or yellow light contribute very little to photosynthesis. This is supported by the low amount of starch produced by the plants exposed to these light colors.
- Blue and/or Red light contribute heavily to photosynthesis. This is supported by the larger amount of starch produced by the plants exposed to these light colors.
- White light is best for photosynthesis. The plant exposed to white light produced the most starch.
- White light is most similar to sunlight. The plant exposed to white light produced the most starch.
- Light is necessary for plants to produce starch. The plant that received no light produced very little starch.
- Light colors affect starch level. Different colored lights resulted in different amounts of starch.
- Other acceptable conclusions and explanations.

Verifying Data:

- Perform the experiment again, under identical conditions.
- Perform the experiment again, but longer.
- Compare your data to data from another student's experiment.
- Add more trials.

Scoring Guide:

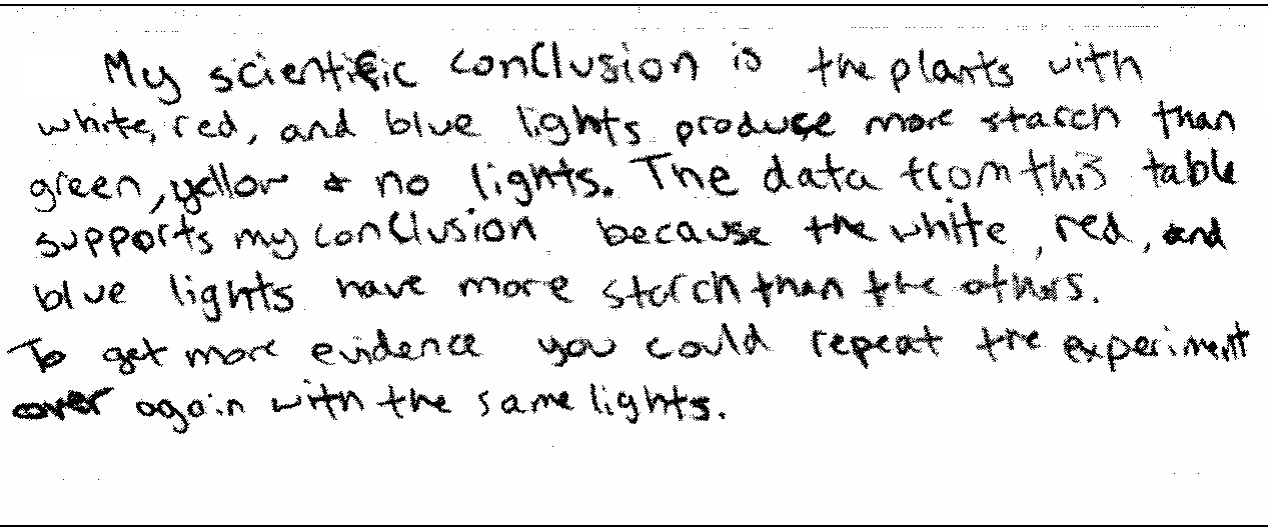
3 The student response demonstrates a complete understanding of the task by drawing a scientifically valid conclusion based on the data, explaining how the data support the conclusion and explaining how the data could be verified.

2 The student response demonstrates a partial understanding of the task by drawing a scientifically valid conclusion based on the data and explaining how the data support the conclusion.
OR
The student draws a scientifically valid conclusion based on the data and explains how the data could be verified.
OR
The student arrives at an unacceptable conclusion but explains how the data support the conclusion and explains how the data could be verified.
OR
The student does not adequately state a conclusion but sufficiently explains the data and explains how the data could be verified.

1 The student response demonstrates an unclear understanding of the task by drawing a scientifically valid conclusion.
OR
The student explains how the data could be verified.
OR
The student arrives at an unacceptable conclusion but explains how the data support the conclusion.

0 The student response demonstrates no understanding of the task.

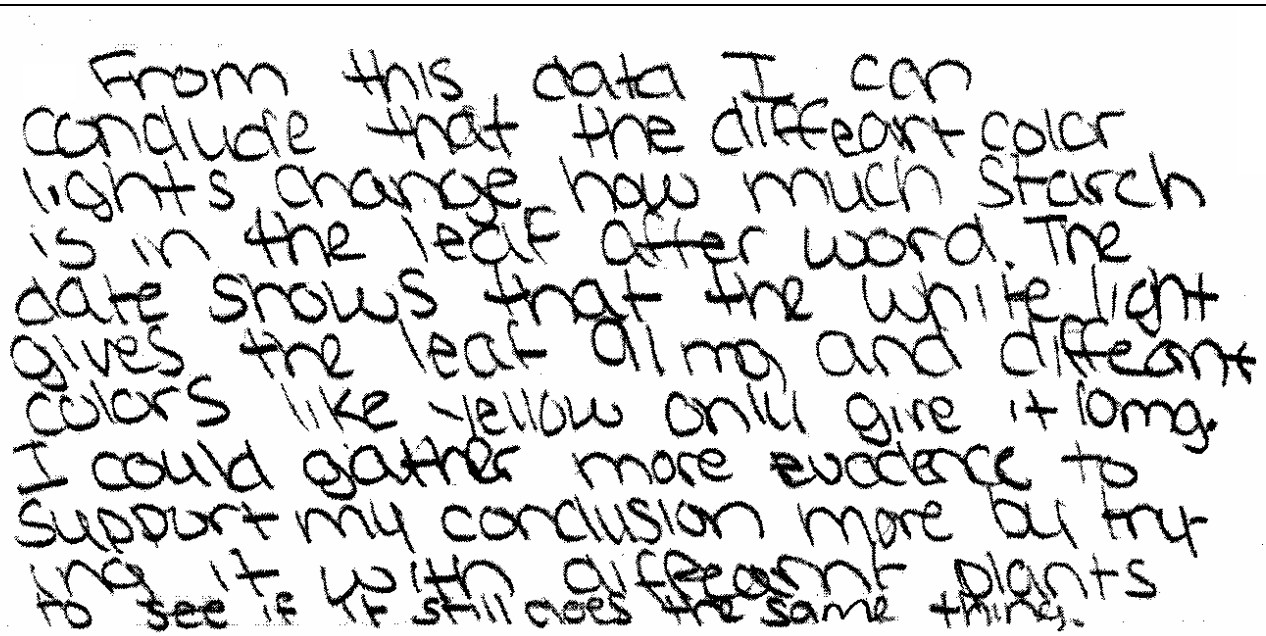
Anchor Paper 1 – Score Point 3



Anchor Paper 1
Score Point 3

The student response demonstrates a complete understanding of the task by correctly drawing a scientifically valid conclusion based on the data *(the plants with white, red, and blue lights produce more starch than green, yellow & no lights)*, correctly explaining how the data support this conclusion *(the white, red, and blue lights have more starch than the others)* and correctly explaining how the data could be verified by correctly describing a way to gather more evidence to support this conclusion *(you could repeat the experiment over again with the same lights).*

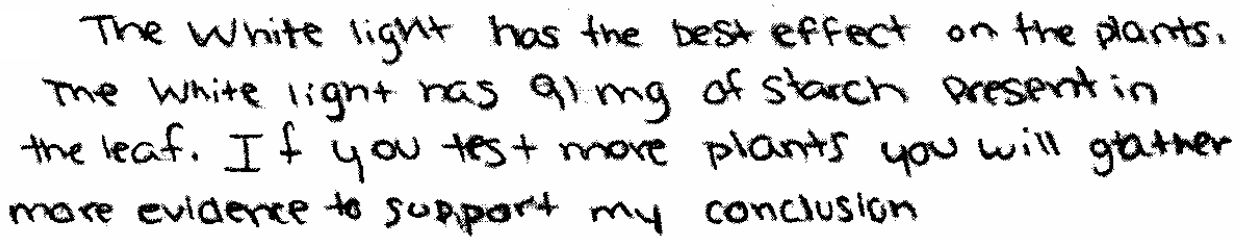
Anchor Paper 2 – Score Point 3



Anchor Paper 2
Score Point 3

The student response demonstrates a complete understanding of the task by correctly drawing a scientific conclusion based on the data *(the diffeart color lights change how much starch is in the leaf after word),* correctly explaining how the data from the experiment support this conclusion *(the white light gives the leaf 91 mg and diffeant colors like yellow only give it 10 mg)* and correctly explaining how the data could be verified by correctly describing a way to gather more evidence to support this conclusion *(by trying it with diffearnt plants to see if it still does the same thing).*

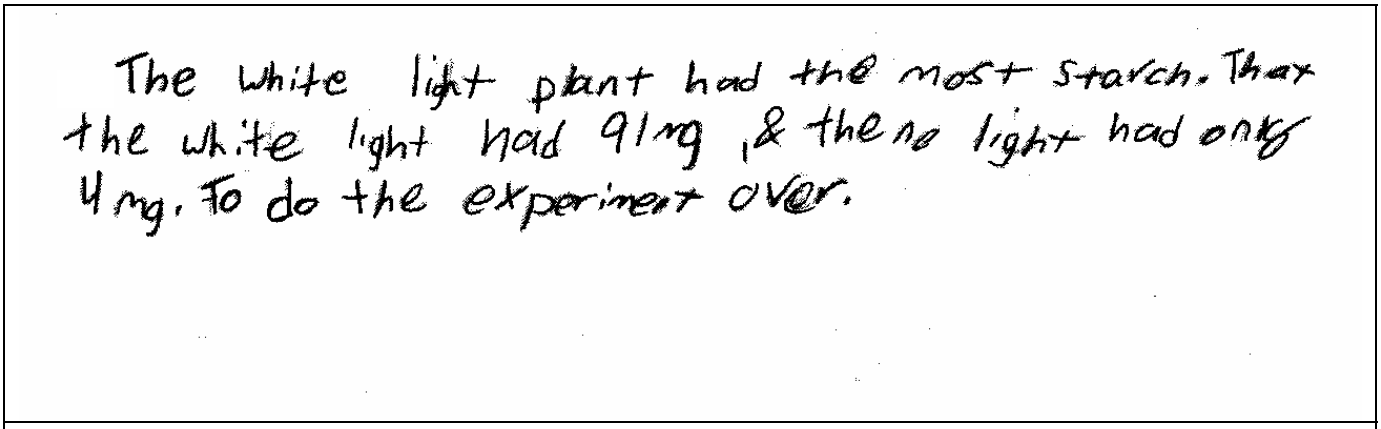
Anchor Paper 3 – Score Point 3



Anchor Paper 3
Score Point 3

The student response demonstrates a complete understanding of the task. The student draws a scientific conclusion based on the data *(The White light has the best effect on the plants)* that, on its own, is not acceptable because the phrase, *"best effect,"* is unclear. However the response does clarify what this *"best effect"* is (more starch) by correctly explaining how the data from the experiment support this conclusion *(The White light has 91 mg of starch present in the leaf),* so both the conclusion and the explanation are acceptable. The student also correctly explains how the data could be verified by correctly describing a way to gather more evidence to support this conclusion *(If you test more plants you will gather more evidence to support my conclusion).*

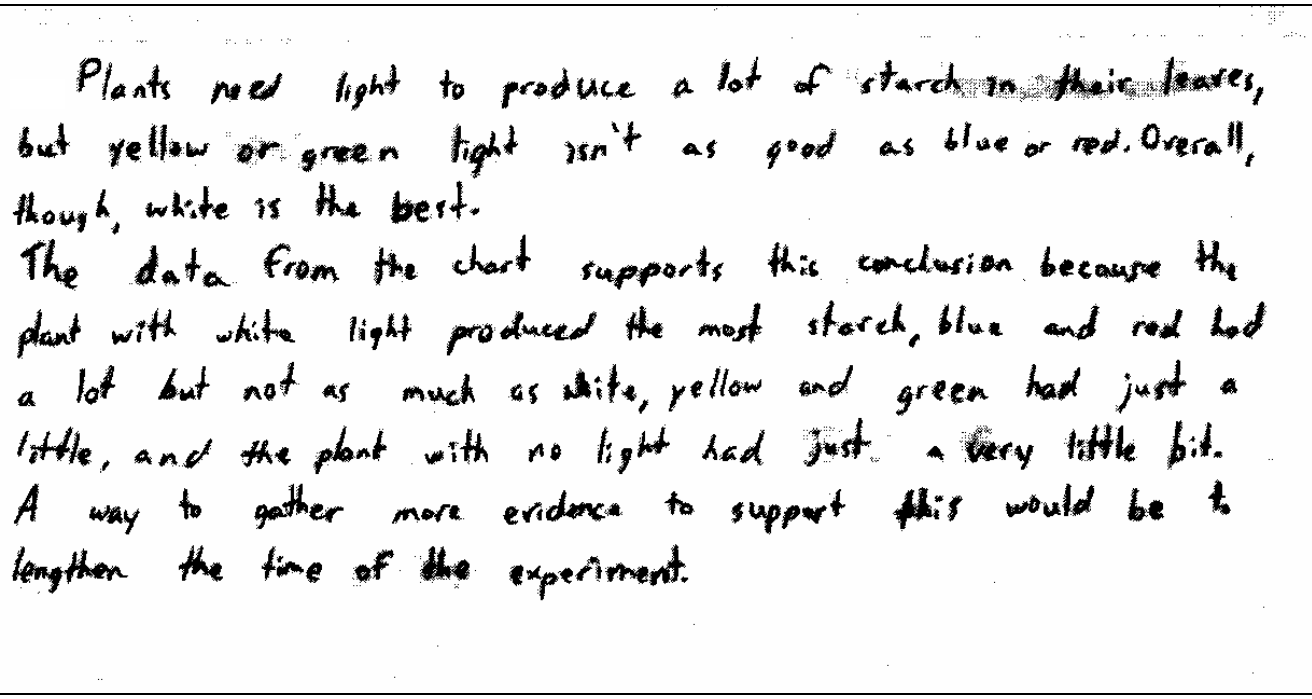
Anchor Paper 4 – Score Point 3



Anchor Paper 4
Score Point 3

The student response demonstrates a complete understanding of the task by correctly drawing a scientific conclusion based on the data *(The white light plant had the most starch),* correctly explaining how the data from the experiment support this conclusion *(That the white light had 91 mg, & the no light had only 4 mg)* and correctly explaining how the data could be verified by correctly describing a way to gather more evidence to support this conclusion *(To do the experiment over).*

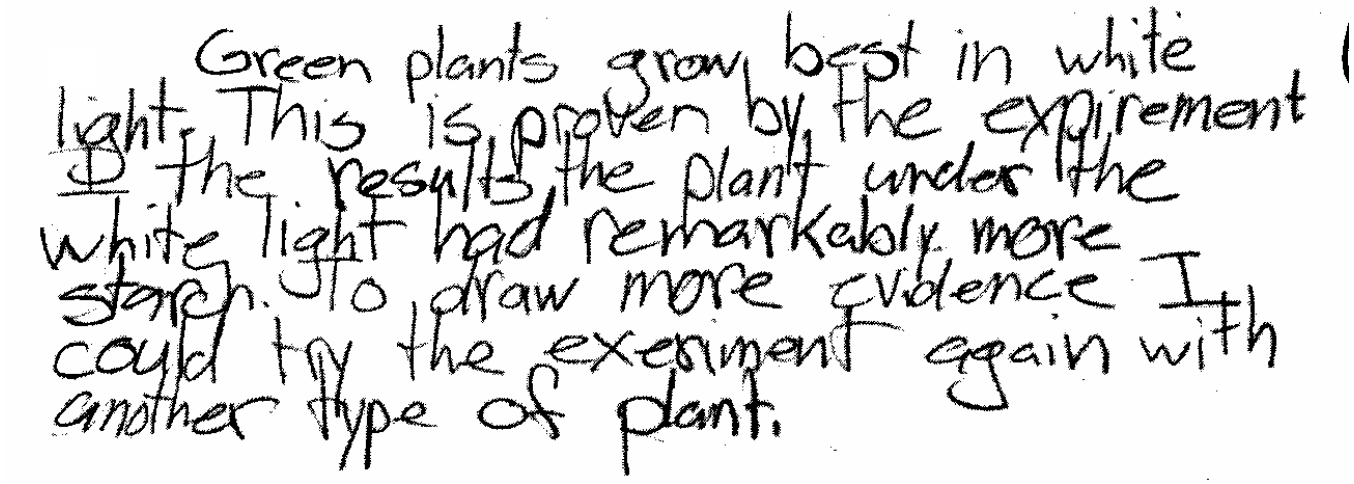
Anchor Paper 5 – Score Point 2


Plants need light to produce a lot of starch in their leaves, but yellow or green light isn't as good as blue or red. Overall, though, white is the best.
The data from the chart supports this conclusion because the plant with white light produced the most starch, blue and red had a lot but not as much as white, yellow and green had just a little, and the plant with no light had just a very little bit.
A way to gather more evidence to support this would be to lengthen the time of the experiment.

Anchor Paper 5
Score Point 2

The student response demonstrates a partial understanding of the task by correctly drawing a scientific conclusion based on the data *(Plants need light to produce a lot of starch in their leaves, but yellow or green light isn't as good as blue or red. Overall, though, white is the best)* and correctly explaining how the data from the experiment support this conclusion *(the plant with white light produced the most starch, blue and red had a lot but not as much as white, yellow and green had just a little, and the plant with no light had just a very little bit).* The description of a way to gather more evidence to support this conclusion, *"lengthen the time of the experiment,"* is not acceptable because there is no implied repeatability (no repetition of trials) and therefore does not explain a way to verify the data.

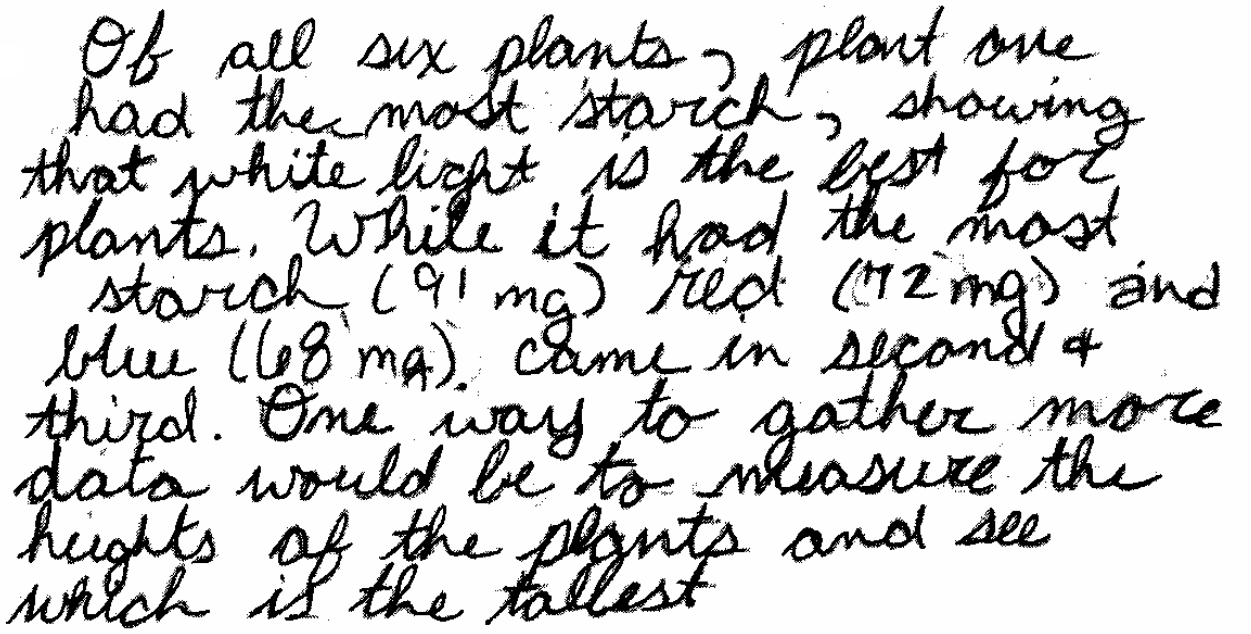
Anchor Paper 6 – Score Point 2



Anchor Paper 6
Score Point 2

The student response demonstrates a partial understanding of the task by arriving at an unacceptable conclusion, *"Green plants grow best in white light,"* but correctly explaining how the data from the experiment support this conclusion *(the plant under the white light had remarkably more starch)* and correctly explaining how the data could be verified by correctly describing a way to gather more evidence to support this conclusion *(I could try the experiment again with another type of plant).* The conclusion is unacceptable because starch production, not growth, is the variable that is being measured against the various light colors in this experiment. Compare with Anchor Paper 3.

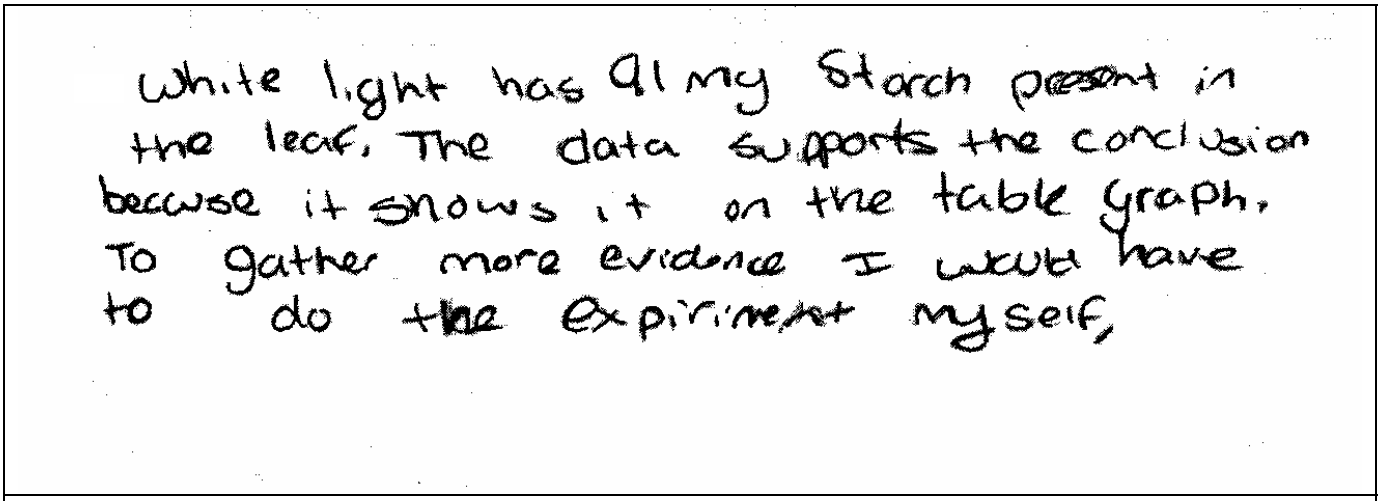
Anchor Paper 7 – Score Point 2


Of all six plants, plant one had the most starch, showing that white light is the best for plants. While it had the most starch (91 mg) red (72 mg) and blue (68 mg) came in second & third. One way to gather more data would be to measure the heights of the plants and see which is the tallest

Anchor Paper 7
Score Point 2

The student response demonstrates a partial understanding of the task. The student draws a scientific conclusion based on the data *(white light is best for plants)* that, on its own, is not acceptable because the phrase, *"best for plants,"* is unclear. However the response does clarify what is *"best for plants"* (more starch) by correctly explaining how the data from the experiment support this conclusion *(Of all six plants, plant one had the most starch...While it had the most starch, (91 mg) red (72 mg) and blue (68 mg) came in second and third),* so both the conclusion and the explanation are acceptable. The description of a way to gather more evidence to support this conclusion, *"measure the heights of the plants and see which is the tallest,"* is not acceptable. Height is not comparable to the amount of starch present in a leaf so this description does not explain a way to verify the data.

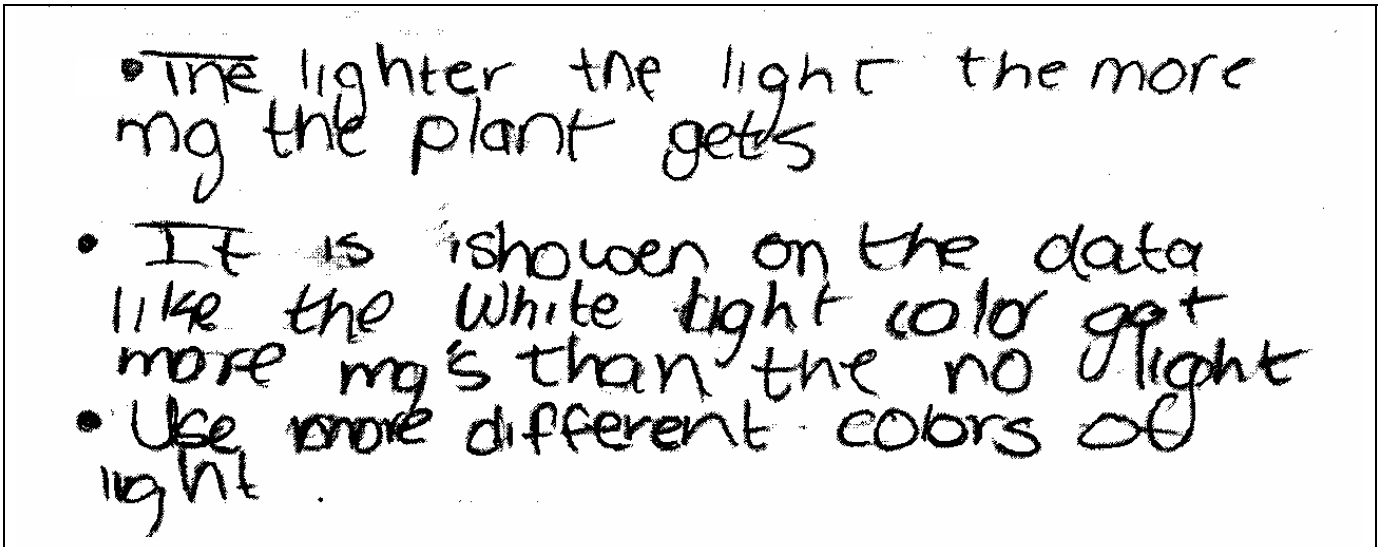
Anchor Paper 8 – Score Point 2



Anchor Paper 8
Score Point 2

The student response demonstrates a partial understanding of the task. The student does not adequately state a conclusion but sufficiently explains the data *(White light has 91 mg Starch present in the leaf)* and correctly explains how the data could be verified by correctly describing a way to gather more evidence to support a conclusion *(I would have to do the expiriment myself).*

Anchor Paper 9 – Score Point 1

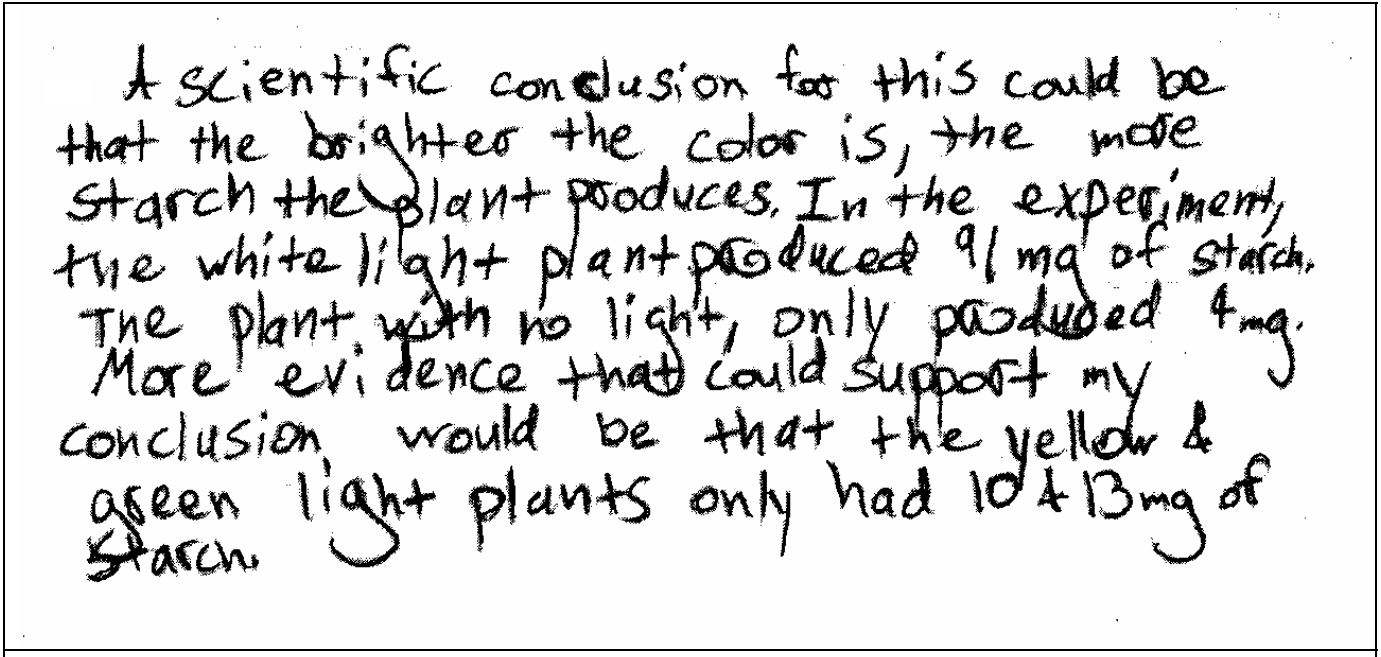


Anchor Paper 9
Score Point 1

The student response demonstrates an unclear understanding of the task by arriving at an unacceptable conclusion, *"The lighter the light the more mg the plant gets,"* but correctly explaining how the data from the experiment supports this conclusion *(the white light color got more mg's than the no light).* Although neither the conclusion nor the explanation reference starch, neither do they identify the *"more mg"* as something unacceptable. Therefore, the use of *"mg"* alone in this response is acceptable as it indicates the use of the table and does not clarify any misconceptions. The description of a way to gather more evidence to support this conclusion, *"Use more different colors of light,"* is not acceptable because it changes the conditions of the experiment (changes the light colors). By changing the conditions the data would not be comparable to the first experiment and could not be used to verify the initial data.

Note: Modifiers such as "darker" and "lighter" are not appropriate for this experiment and are not acceptable as a response. Any conclusion or explanation using these words alone will not be able to accurately describe the data and will be incorrect. For example in this response, both blue and red, darker colors than yellow, result in more starch present in the leaf than the lighter color yellow, so stating that *"The lighter the light the more mg the plant gets,"* for the conclusion is incorrect.

Anchor Paper 10 – Score Point 1

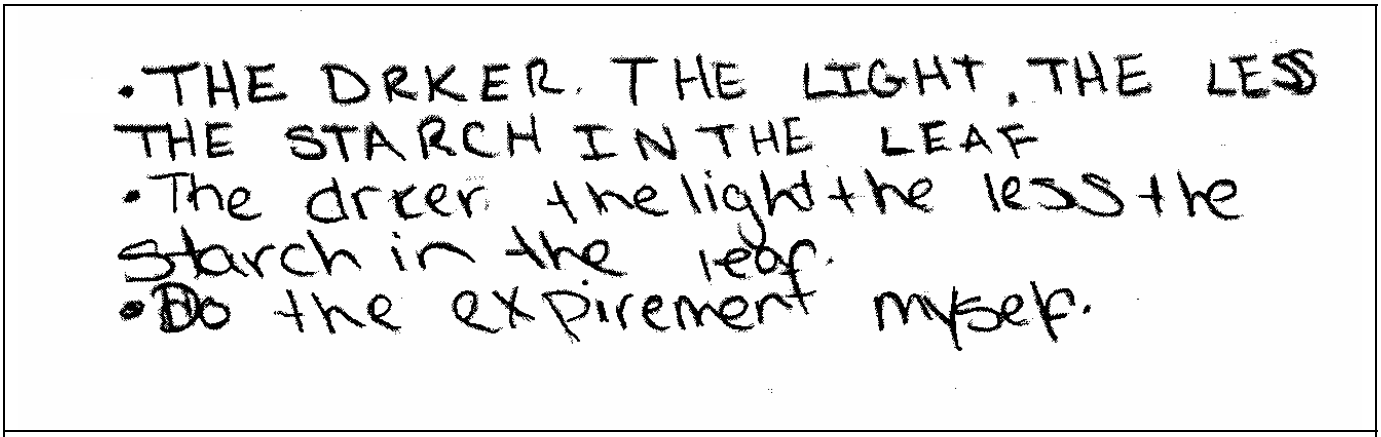


Anchor Paper 10
Score Point 1

The student response demonstrates an unclear understanding of the task by arriving at an unacceptable conclusion, *"the brighter the color is , the more starch the plant produces,"* but correctly explaining how the data from the experiment support the conclusion *(In the experiment, the white light plant produced 91 mg of starch. The plant with no light, only produced 4 mg. More evidence that could support my conclusion, would be that the yellow & green light plants only had 10 & 13 mg of starch).*

Note: The modifier *"brighter"* is not acceptable as a response. Brightness indicates light intensity which is not part of this experiment so it is incorrect.

Anchor Paper 11 – Score Point 1

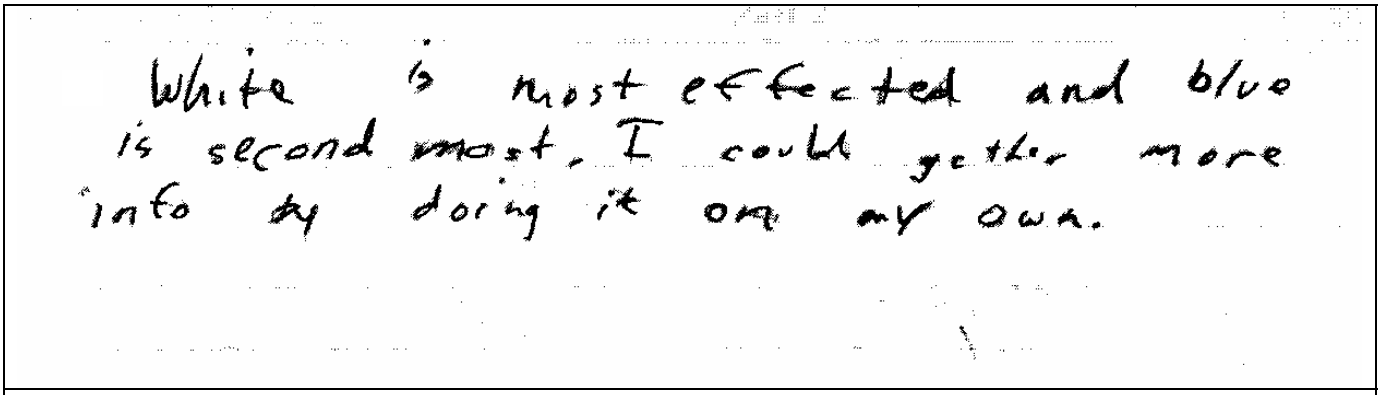


Anchor Paper 11
Score Point 1

The student response demonstrates an unclear understanding of the task by correctly explaining how the data could be verified by correctly describing a way to gather more evidence to support a conclusion *(Do the expirement myself).* The response, *"The Drker the light the less the starch in the leaf,"* is incorrect and an unacceptable conclusion. Similarly, the response, *"The drker the light the less the starch in the leaf,"* does not correctly explain the data so is unacceptable.

Note: Modifiers such as "darker" and "lighter" are not appropriate for this experiment so are not acceptable as a response. Any conclusion or explanation using these words alone will not be able to accurately describe the data, so it will be incorrect. For example, in this response the conclusion and explanation, *"The drker the light the less the starch in the leaf,"* are both incorrect because both blue and red, darker colors than yellow, result in more starch present in the leaf than the lighter color yellow. See also Anchor Paper 9.

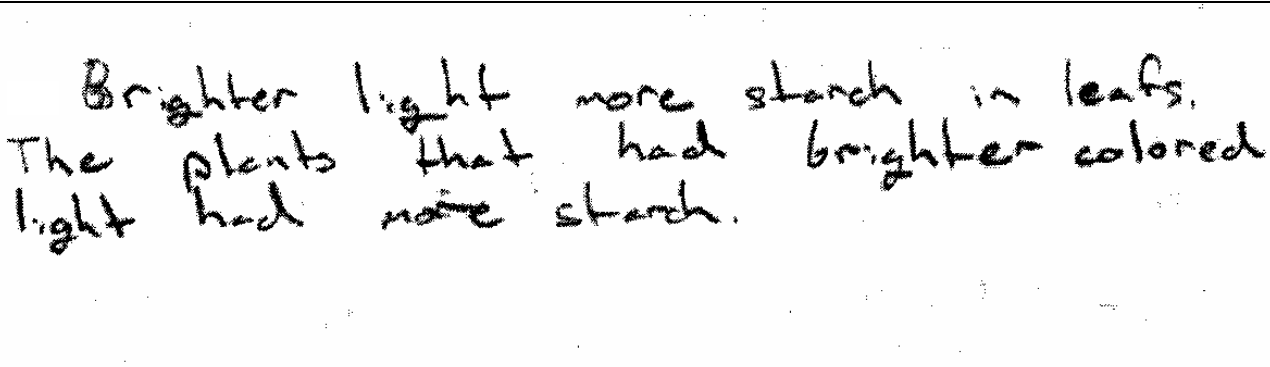
Anchor Paper 12 – Score Point 1



Anchor Paper 12
Score Point 1

The student response demonstrates an unclear understanding of the task by correctly explaining how the data could be verified by correctly describing a way to gather more evidence to support a conclusion *(I could gather more info by doing it on my own).* The response, *"White is most effected and blue is second most,"* is not acceptable as a conclusion because the phrase *"most effected"* is unclear and not clarified. Compare with Anchor Papers 3 and 7.

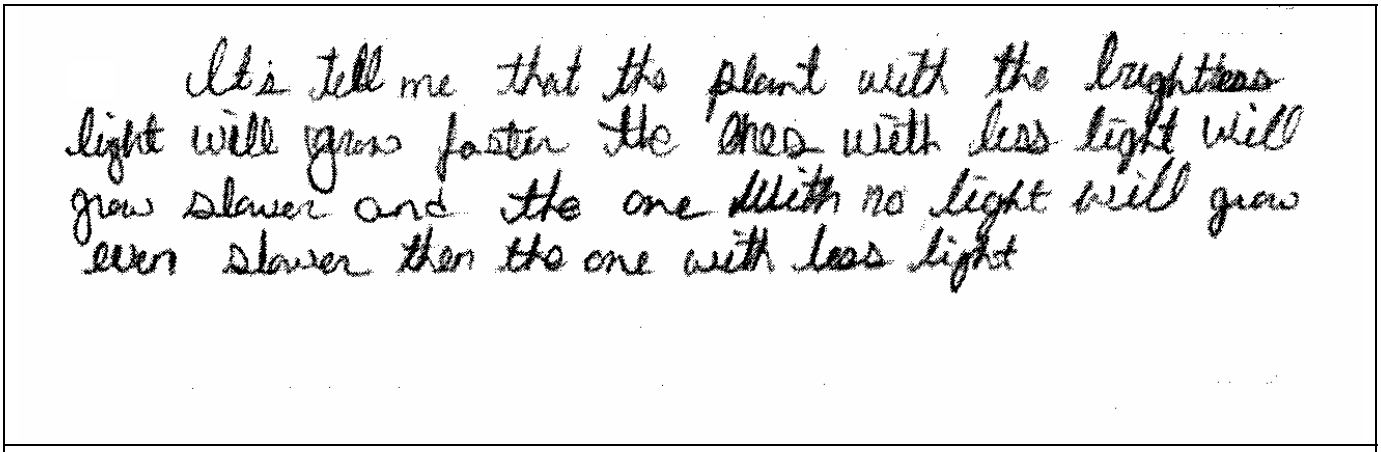
Anchor Paper 13 – Score Point 0



Anchor Paper 13
Score Point 0

The student response demonstrates no understanding of the task. The response, *"Brighter light more starch in leafs,"* is unacceptable as a conclusion because brightness indicates light intensity which is not part of this experiment so it is incorrect. Similarly the response, *"The plants that had brighter colored light had more starch,"* is unacceptable as an explanation of how the data support the conclusion. Compare with Anchor Paper 10.

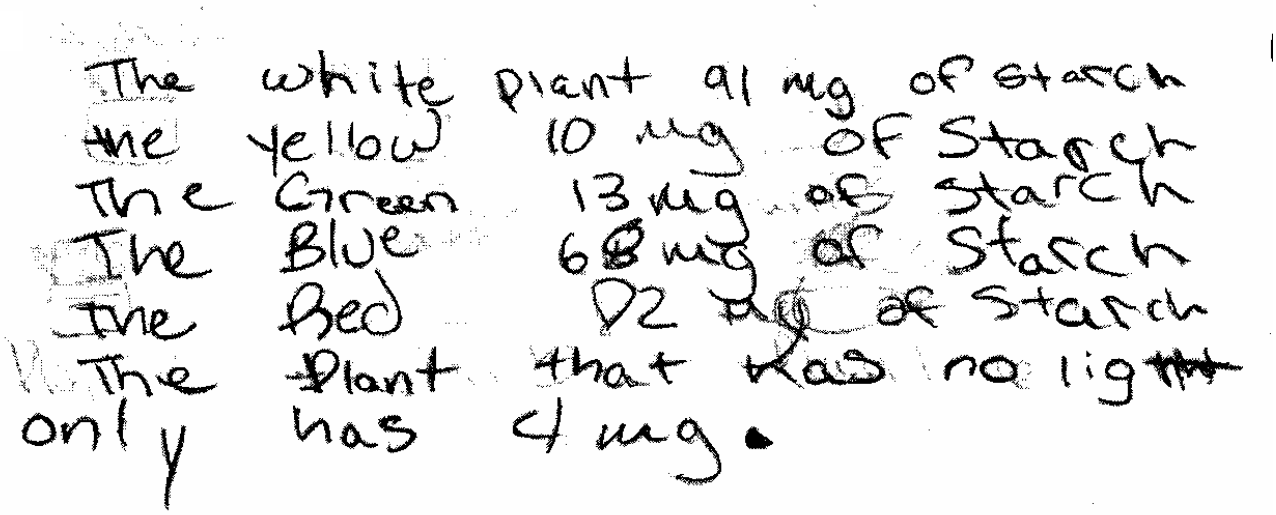
Anchor Paper 14 – Score Point 0



Anchor Paper 14
Score Point 0

The student response demonstrates no understanding of the task. The response, *"Its tell me that the plant with the brightess light will grow faster the ones with less light will grow slower and one with no light will grow even slower then the one with less light,"* is incorrect and unacceptable as a conclusion. Brightness indicates light intensity which is not part of this experiment, growth is not the variable that is being measured, and other than the plant with no light, no plants received less light then the others.

Anchor Paper 15 – Score Point 0



Anchor Paper 15
Score Point 0

The student response demonstrates no understanding of the task. The response, *"The white plant 91 mg of starch the yellow 10 mg of starch The Green 13 mg of starch The Blue 68 mg of starch The Red 72 mg of starch The Plant that has no light only has 4 mg,"* is a restatement of the data table and on its own is insufficient to demonstrate any understanding.